Appl. No. 10/785,002
Amendment dated June 1, 2006
Reply to Office Action of March 6, 2006

Docket No. 274.43165X00

REMARKS

Claims 1, 4, 8, 22, 24 and 28 have been amended. Claim 26 has been canceled. No new claims have been added. Accordingly, claims 1-25 and 27-28 are pending in this application.

Specification

The specification has been amended to add missing reference numerals and correct minor informalities. No new matter has been added.

Drawings

The objection to the drawings has been addressed by the submission of replacement drawing sheets including corrected FIGS. 2A-E, as detailed above. In addition, other minor informalities in the drawings have been corrected, as detailed above. No new matter has been added.

35 U.S.C. §§102 and 103

Claims 1-28 stand rejected under 35 U.S.C. §102(e) as being anticipated by Yanai et al. (U.S. Pub. No. 2004/0073831 - hereafter "Yanai"). Applicants request reconsideration of the rejections for the following reasons.

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Discussion of the Invention

The present invention teaches storage using both local and remote mirroring configurations. Thus, host write I/O commands issued by the host 110 to the first storage system 101, cause write data to be written not only in the <u>primary volume</u> 103 but also in the <u>local secondary volume</u> 109 and the <u>remote secondary volume</u> 106. The remote mirroring pair of primary volume 103 and remote secondary volume 106 can be configured to be in the synchronous mode where data stored in the primary volume 103 is immediately stored in the remote secondary volume 106. (See, e.g., page 7, lines 11-17 of the specification of the present application.)

An objective of the present invention is that journal logs 104, 107 and base images 105, 108, or alternatively a snap shot image, are used to recover data on the primary volume 103 or remote volume 106, respectively, without suspending synchronism between the primary and remote secondary volumes. Specifically, recovery of data on the primary volume 103 is accomplished by applying commands and other information included in the journal logs 104 in the local secondary volume 109 to the base volume or snap shot image 105 of the local secondary volume 109 with the result being stored on the primary volume 103. In addition, or alternatively, data can be recovered on the remote secondary volume 106 by applying commands and other information included in the journal logs 107 to the base volume or snap shot image 108 of the remote secondary volume 106 with the result being stored on the remote secondary volume 106. (See, e.g., page 7, line 18, through page 8, line 9

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of the specification of the present application.) Thus, the present invention

eliminates the need to suspend the synchronous mode between the remote mirrored

pair of the primary volume 103 and remote secondary volume 106, which overcomes

the disadvantages of the conventional technique described in FIGS. 2A-2E.

Discussion of Yanai

The cited reference to Yanai discloses a system and method for automatically

providing and maintaining a copy of mirrored data stored at a location that is

geographically remote from the main storage device. Two data storage systems are

interconnected by a data link for remote mirroring of data. Each volume of data is

configured as a local volume, a primary in a remotely-mirrored volume pair, or a

secondary in a remotely-mirrored volume pair. (See, e.g., Abstract and par. [0011]-

[0017].)

Yanai Does Not Teach Claims 1 and 15

However, Yanai fails to teach a local secondary volume in the first storage

system, the "local secondary volume having stored therein journal logs of write

input/output (I/O) commands issued by the host to the primary volume to store write

data in the primary volume and old data including write data of the write I/O

commands", as required by claim 1. Instead, Yanai merely teaches that "each

storage device 20, 48 may include one or more local volumes or storage devices

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22c, 50c, <u>which are accessed only by their locally connected data processing</u>

<u>systems</u>." (See, e.g., par. [0068] of Yanai; emphasis added.) Thus, Yanai fails to

teach anything equivalent to the local secondary volume of the present invention.

The Office Action asserts that a local secondary volume is shown in FIG. 12,

as element 291. However, FIG. 12 itself clearly shows that element 295 is the

primary volume and that element 291 is a <u>file</u> stored in the primary volume 295.

Further, the text associated with FIG. 12, starting at par. [0233], shows that the

remotely mirrored volume pair consists of the primary volume 295 in the primary data

storage system 214 and the secondary volume 296 in the secondary data storage

system 246. An application maintains a log <u>file</u> 291 and a data <u>file</u> 292 on the

primary volume 295, and copies the log file 291 and the data file 292 to the

secondary volume 296 as log file 293 and data file 294, respectively. Thus, Yanai

teaches nothing more than a conventional mirroring technique in which a data file

and a log file on a primary volume 295 are mirrored to a secondary volume 296 at a

remote site.

Further, par. [0027] of Yanai, also cited in the Office Action as teaching a local

secondary volume having journal logs, clearly states that there is only a primary copy

and one secondary copy of the log files R1, R2 and the data files R1, R2. This

paragraph further teaches that log and data files R2 are written by the <u>remote</u>

mirroring facility. Thus, this portion of Yanai also does not teach the present

invention. Nowhere in Yanai is there taught or suggested a local secondary volume

(e.g., item 109 in FIG. 1A of the present application) that includes a log 104 and a base volume 105. As state above, this is a feature of the invention that enables recovery of data on the primary volume 103 without suspending synchronization between the primary volume 103 and the remote secondary volume 106. (See, e.g., page 7, line 18, through page 8, line 9 of the specification of the present application.) Since Yanai teaches storing the log file and the data file in the primary volume, Yanai's arrangement would be incapable of achieving this advantage of the present invention.

What is more, claim 1 is additionally patentable over Yanai, since Yanai fails to teach "conducting recovery of data on the primary volume from the local secondary volume when necessary by performing recovery of data of the primary volume based on the old data and the journal logs while maintaining the primary volume and the remote secondary volume in the synchronous mode", as recited in claim 1. As discussed above, Yanai fails to teach a local secondary volume. Further, Yanai fails to teach recovery of data on the primary volume from a local secondary volume while maintaining the primary volume in synch with the remote secondary volume. This is neither taught nor suggested by Yanai or the other art of record, and accordingly, claim 1 is additionally patentable for this limitation. Claim 15 is patentable for the same reasons discussed above with respect to claim 1. Accordingly, claims 1 and 15 are patentable over Yanai and the other art of record.

Yanai Does Not Teach or Suggest Claim 10

Additionally, independent claim 10 includes additional limitations not

addressed in the Office Action. Claim 10 recites:

> providing a local secondary volume in the first storage system,
> wherein the local secondary volume has stored therein journal logs of
> write input/output (I/O) commands issued by the host to the primary
> volume to store write data in the primary volume and a base volume
> including an image of the primary volume at a certain point in time,

Yanai fails to teach a local secondary volume, as discussed above with

respect to claims 1 and 15. Further, Yanai also fails to teach any volume on the first

storage system that includes journal logs of write I/O commands issued to the

primary volume <u>and a base volume</u> including <u>an image</u> of the primary volume at a

certain point in time. This not taught or suggested anywhere in Yanai or the other art

of record, and was not addressed in the rejection of claim 10 in the Office Action.

The base volume enables recovery of the primary volume from the local secondary

volume. (See, e.g., page 7, lines 18-22 of the specification of the present

application.)

Yanai Does Not Teach Claim 24

Claim 24 is patentable for the same reasons discussed above with respect to

claims 1, 10 and 15. Additionally, as amended, claim 24 includes the limitation that:

> the recovery of data on the remote secondary volume is performed by
> applying the journal logs on the remote secondary volume to the replica
> base volume on the remote secondary volume, and storing the result in

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the base volume of the remote secondary volume while maintaining the primary volume and the remote secondary volume in the synchronous mode

Yanai provides no teaching of <u>a base volume and a replica base volume</u> on the second storage apparatus, and Yanai provides no teaching of recovering data on the remote secondary volume by applying journal logs on the remote secondary volume to the <u>replica</u> base volume on the remote secondary volume. Accordingly, claim 24 is also patentable over Yanai for this limitation.

Further, the dependent claims are directed to additional patentable features of the invention neither taught nor suggested by Yanai or the other art of record, and are patentable at least because they depend from allowable base claims.
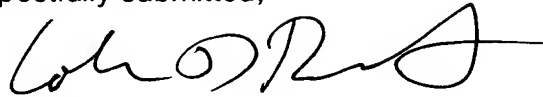
Request for Interview

After reviewing the foregoing remarks, should the Examiner still believe that Yanai teaches the claimed invention, the Examiner is respectfully requested to contact the undersigned so that an interview might be scheduled to resolve in a more expeditious manner any remaining differences in interpretation of Yanai and the pending claims.

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Conclusion

In view of the foregoing, Applicant respectfully requests that a timely Notice of

Allowance be issued in this case.

Respectfully submitted,

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Amendments to the Drawings

The attached sheets of drawings include changes to FIGS. 2A-E, 3A-B, 5A, 5C, and 7E. These sheets which include FIGS. 2A-E, 3A-B, 5A, 5C, and 7E replace the original sheets including FIGS. 2A-E, 3A-B, 5A, 5C, and 7E. In FIGS. 2A-E, the figures have been indicated to be "Related Art". In FIG. 3A, reference number 101 has been added. In FIG. 3B, reference numbers 101 and 102 have been added. In FIG. 5A, "Table 6" has been removed from the figure and other informalities corrected. In FIG. 5C, "table 6" has been changed to "table 115" to conform with the text of the specification. In FIG. 7E, the figure number designation has been changed from "FIG. 7" to "FIG. 7E" and step 702 has been revised to conform to the specification.

Attachments: 10 Replacement Drawing Sheets